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# Research Briefs

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## Nutrition and Health

**Middle-age diabetes doesn't happen overnight.** Blood glucose and insulin levels creep ever higher as the hormone loses its effectiveness in metabolizing glucose. Finally, the body may stop producing insulin altogether. A new study indicates that getting enough chromium each day can nip this process in the bud. Seventeen men and women ate diets containing less than 40 percent of the minimum suggested chromium intake. This reflects the daily intake of about one-fourth of the U.S. population. After adjusting to this diet, the volunteers alternated between 5-week periods when they got a 200-microgram supplement—the maximum suggested chromium intake—or a look-alike placebo. The eight volunteers who began the study with slightly elevated glucose and insulin levels had a significant improvement in glucose tolerance with the chromium supplement. But it had no effect on the nine volunteers who started with desirable glucose and insulin levels. The findings suggest that very low chromium intakes may be putting millions of middle-aged Americans on the road to diabetes and that the process could be reversed simply by getting adequate chromium. That's easier said than done, however, because it's hard to get even the minimum suggested intake—50 mcg/day—through foods. Some of the best sources are cold cereals, especially the brands fortified with vitamins and minerals, broccoli and grape juice.

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**The person who can eat and eat and never gain a pound probably doesn't exist.** Seven healthy young men of average weight agreed to eat an extra 1,000 calories a day for 3 weeks so that researchers could use the latest techniques to resolve conflicting reports on overeating. About half these reports found no weight gain and concluded that people burn off or "waste" extra calories through an increase in basal, or resting, metabolism even though metabolic rates were not measured. The other reports didn't find a change in metabolism but did see an increase in weight. In the new study, all seven men gained weight accounting for about 85 to 90 percent of the extra 1,000 calories they ate. The other 10 to 15 percent showed up in an increased resting metabolic rate, most of which was needed to digest, absorb, convert and store these calories. Agreement on this fundamental issue is important in helping to define the causes of obesity and in improving methods to prevent and treat it.

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**Young women who avoid eating whole grains, vegetables, nuts and seeds may be losing more than iron during menstruation.** Plant foods are virtually the only source of the essential element manganese. A 5-1/2-month study of manganese requirements turned up a surprising finding: When the dietary level was sharply reduced, menstrual loss of other minerals increased. The 15 young women in the study lost between 50 and 100 percent more iron, copper, zinc and manganese through their menstrual flow when their manganese intake was reduced to a very marginal 1 milligram (mg) per day. That's because they lost about 50 percent more menstrual fluid while on the low-manganese diet. It's known that high doses of some minerals interfere with the absorption or use of other minerals. This is the first indication that the dietary level of a mineral—and low doses at that—can influence the loss of other minerals. However, a low-manganese intake is likely not the cause of heavy bleeding in most women because intakes are generally much higher than 1 mg/day.

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**Older women** who get less than half the recommended amount of calcium can benefit greatly by increasing their intake, according to a 2-year study of 361 women past menopause. In those women with the lowest normal intakes—less than 400 mg daily—an extra 500 mg of calcium daily cut bone loss to less than 1 percent in the hip and spine over the 2 years, but only if the women were 6 or more years past menopause. It was not effective in the women who had stopped menstruating within 5 years of the study's beginning. The loss of estrogen, which prompts rapid bone loss, apparently overrides the benefits of getting adequate calcium for several years. Extra calcium also didn't slow bone loss in those women who normally consumed between 400 and 650 mg of calcium daily. The average calcium intake from food sources for U.S. women 50 years and older is estimated at 560 to 600 mg/day. That means millions of American women are getting much less than the average from their diet. The best sources of calcium are food sources, particularly low-fat milk, yogurt and cheeses.

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**A salmon-rich diet** increased levels of a compound that—in high amounts—can lower the risk of heart disease. For 40 days during a 100-day experiment, male volunteers ate salmon entrees for lunch and dinner. Purpose: To provide data for researchers who want to clarify the relation between a fish-rich diet and a lowered risk of heart disease. During the salmon regimen, one type of high density lipoprotein (HDL<sub>2b</sub>) increased in the volunteers' blood an average of 10 percent. HDL removes cholesterol and fats from arteries. The lipoprotein is usually not high in men, but is typically elevated in premenopausal women, who in turn have less risk of heart disease than men. The finding may be unique, as most earlier experiments with omega-3 fatty acids—found mostly in fish—didn't investigate the HDL<sub>2b</sub> lipoprotein subfraction.

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**The first indication** that eating fruits and vegetables may help delay cataracts comes from a study of 112 people in the Boston area. Men and women between the ages of 40 and 70 were asked how frequently they consumed a wide range of foods. Those who ate less than one and a half servings of fruit or fruit juice per day or less than two servings of vegetables or vegetable juice were 3.5 times more likely to have cataracts. If the combined fruit and vegetable intake was less than three and a half servings per day, cataracts were 5.7 times more likely. Further research is needed to verify these findings. Meanwhile, there are many other reasons to add more fruits and vegetables to your diet if you fall on the short side.

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**A strain of *Lactobacillus acidophilus* bacteria**—known as ADH—can reduce the level of carcinogen-producing enzymes in the gastrointestinal (g.i.) tract, researchers are finding. These unwanted enzymes convert potential carcinogens into substances known to promote cancer in animals. Researchers are attempting to colonize the g.i. tracts of older people with beneficial bacteria in hopes of reducing cancer risk and improving absorption of certain vitamins. In tests, eight older men and women had almost half as many carcinogen-producing enzymes in their stools after they took capsules containing live ADH twice a day for 12 days. Eight other volunteers, who ate yogurt twice a day instead, had a slight but statistically insignificant reduction in these enzymes. Yogurt is currently made with two other types of bacteria but could easily be made with ADH. While there's no hard evidence that these enzymes increase colon cancer in people, scientists believe there's a good chance they do.

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**Although all newborn infants** are severely deficient in vitamin K at birth, only a small percentage of them develop life-threatening bleeding problems. ARS researchers recently found that 10 percent of newborns have faulty prothrombin—the protein that makes blood clot. And more than 40 percent have nonfunctioning protein C, which retards clotting. Production of both proteins depends on vitamin K. Hospitals routinely give infants vitamin K shots at birth to prevent cerebral hemorrhage. But this doesn't help the fetus before and during delivery, and a few do suffer hemorrhage. ARS and University of Vermont researchers are collaborating to see if supplementing pregnant women with vitamin K will help raise the level of this vitamin in the fetus and correct the faulty production of prothrombin and protein C during gestation.

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**Women being treated** for an underactive thyroid could be losing more bone than normal if the hormone dosage is too high. People who secrete excess thyroid hormone are known to have increased risk for osteoporosis. So when researchers conducted a 2-year trial to assess the benefits of calcium supplements for women during and after menopause, they took a special look at the 18 participants being treated with thyroid hormone. Ten of these women were getting more hormone than needed, based on a sensitive new assay of thyroid stimulating hormone (TSH) levels. And they lost bone in the wrist and spine at a significantly faster rate than over 235 "controls" with normal thyroid function.

Loss of bone from the hip also tended to be faster in the 10 women. Physicians need to keep close tabs on patients getting synthetic thyroid hormone to prevent unnecessary bone loss.

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## ***Tomorrow's Foods and Fibers***

**Two new seedless grapes**—one black and one bright red—could be on the market in 3 to 5 years. Every major grape nursery in California—the leading producer of fresh-market grapes—has asked for cuttings of the new grapes developed by ARS. Fantasy Seedless, a black grape for mid-summer, is sweet and firm, with naturally large berries. That's good news for growers, who won't need to boost berry size by applying a growth regulator or by girdling the plants (making an incision around the base of the vine to change the flow of nutrients and force berry growth). Both tactics add to production costs. Crimson Seedless red grapes, for September and October harvest, are medium to large, with light yellow flesh. This new grape variety may someday replace Emperor, a red grape that ripens about the same time, but contains seeds.

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**A new potato variety for chips**—Gemchip—absorbs less oil during frying than the popular Norchip variety because it has a higher solid content. This is a bonus for consumers and processors alike since oil is both caloric and costly. ARS scientists bred Gemchip, which yielded 30 percent more U.S. No. 1 grade potatoes in field tests than Norchip and got high marks for chip quality by several chip manufacturers. Frontier Russett, a high-yielding baking potato variety developed by ARS scientists, also makes good french fries straight from the field or after a few months of storage at 45 degrees F. Frontier Russet has been grown commercially for 3 years, after its selection and early testing by ARS and agricultural experiment station cooperators.

*Small Grains and Potato Germplasm Research  
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**Ski clothing and other sportswear** made from fabrics that respond to changes in temperature will soon become available, now that a small Iowa firm and one of Japan's largest companies have received exclusive licenses to develop these and other products. Using a process developed by ARS scientists, the thermal fabrics are treated with a class of chemicals called polyethylene glycols or with other compounds known as plastic crystals. In lab tests, the fabrics

absorbed and stored heat when the temperature rose and released it when the temperature dropped. How much heat the treated material will store and release depends on the kind of fabric, the chemical applied and the amount used. NeutraTherm, Inc. of Des Moines will develop ski clothing, other sportswear and biomedical products. Mitsui & Company of Tokyo will make mainly sportswear and biomedical products for sale only in Japan. Companies in France, Italy and Australia also have applied for licenses to use the patented technology. And several other U.S. and Canadian companies are interested in licensing the technology for various uses—such as in carpets, footwear, automotive interiors and fabrics for agricultural applications.

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**Corn**—one of the most difficult plants to genetically engineer—has yielded to ARS and Monsanto Co. researchers who have succeeded in transferring new genes into the plant. Their work paves the way for introducing valuable new traits, such as resistance to insects or disease, into corn and other monocots such as wheat, oats, barley and rice. Monocots—plants that put forth one leaf from germinating seed—are far more resistant to gene insertion than dicot plants with two seed leaves, such as tomato. This research is among the first to apply techniques of modern biotechnology to move new genes into corn cells that later produced healthy, fertile plants. In turn, these parent plants passed the new genes to their offspring. Monsanto funded part of the research and provided special lab cultures of corn cells that accepted new genes fired from a "gene gun."

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**"Tuning up" crude soybean oil** with sound waves can produce a better salad dressing. The new oil processing method uses ultrasound—very high frequency sound waves—to get rid of gummy impurities. It could replace today's more complicated and costly processing. With the new technique, soybean "crude" is sound-vibrated at 20,000 times per second in a mix of water and citric acid. With all the shaking going on, tiny bubbles continuously form and pop, creating mini-sites of extreme heat where flavor-damaging gum compounds cluster. The gums—fatty acids and phospholipids—are easily spun away with a centrifuge. What's left is a partially processed oil for further refining into a flavorful soy oil. Taste panelists couldn't distinguish the refined oil from the conventionally processed kind.

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## **Food and Water Freshness and Safety**

Evidence grows that some herbicides and insecticides can return to Earth in rain, snow, dew and fog—depositing significant amounts of the chemicals where they were not applied. ARS scientists analyzed rain samples collected along the eastern shore of the Chesapeake Bay during the summers of 1981, 1982 and 1984. They estimate that during each of the three summers 1,323 pounds of atrazine, between 3 and 11 tons of alachlor, 1,190 to 2,325 pounds of toxaphene and 242 to 309 pounds of simazine fell on the Bay in rainfall alone. Toxaphene, an insecticide, is now banned by the Environmental Protection Agency. The other three chemicals are herbicides, most frequently used on corn. These analyses, along with previous ARS studies, indicate that some farm chemicals travel hundreds of miles by air before coming to rest on land or in waterways such as the Bay.

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**Strawberries may have a new ally**—a bacterium naturally occurring in apple leaves. ARS scientists discovered that the bacterium's weapon, a compound called pyrrolnitrin, destroys micro-organisms that cause fruit rot and other molds on harvested strawberries. As a result, berries have a longer shelf life. Dipping the berries in a solution of 250 milligrams of pyrrolnitrin per liter of water increases shelf life at room temperature from 2 to 5 days. Spraying the plants with the compound controls rot organisms as effectively as approved levels of fungicides. Scientists will continue to study how pyrrolnitrin and other naturally produced compounds can further protect crops as a replacement for fungicides, which face increasing restrictions because of a growing concern for environmental safety.

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**Imitation flavors**, priced and sold as all-natural products, should be easier to detect now. A simple new technique separates key flavor compounds of apples, pineapples and strawberries into two distinctive forms—one natural and one a tip-off to synthetic flavorings. Similar analysis might be done by food manufacturers on dozens of fruits that contain the two flavor forms, called enantiomers. Because enantiomers can differ drastically in aroma, potency, and other characteristics, the technique could also be used to make sure products such as perfumes, medicines and lures for insect control contain the desired form.

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**Light energy emitted by fruit** may some day be measured on processing lines to ensure that fruit wasn't picked too early. If picked too soon, fruit won't ripen to proper

maturity and quality by the time it reaches the grocery shelf. ARS scientists are studying a system based on the principle of delayed light emission (DLE) as an objective way to measure maturity. Fruit is now classified for maturity by mechanical sorters that account for weight, size and color. DLE, however, is a low intensity light emitted for several seconds or minutes from chlorophyll-containing fruit tissue after exposure to light. As fruits ripen, the chlorophyll content decreases, reducing the amount of light emitted. Changes unseen by the naked eye can be detected with DLE. Scientists are developing a maturity index that includes information on other factors such as carotene, sugars and firmness which are known to be related to maturity and can be correlated with a DLE reading.

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**Current methods of processing frankfurters** prevents growth of the food-poisoning bacterium *Listeria*, ARS studies show. Heating raw beef or pork frankfurters to an internal temperature of 160 degrees Fahrenheit for 70 minutes will adequately control the organism that causes listeriosis. Although different processors use different heating steps to achieve particular qualities, such as texture or flavor, all meet or exceed the 160 degree/70 minute standard. Until now, only milk pasteurization had been analyzed at various levels to determine the rate of *Listeria* destruction. These studies will help establish regulations for preventing *Listeria* contamination in processed frankfurters and other cooked sausages.

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**Broccoli and cabbage growers** could enlist certain wasps and flies to ward off damage from crop-munching caterpillars. And this could reduce or eliminate grower's reliance on pesticides. Carefully timed releases of seven different species of parasitic wasps and flies killed populations of three major caterpillar pests in experimental broccoli plots. Damage from the pests—cabbage loopers, imported cabbage worms and diamondback moths—costs growers of broccoli, cabbage and other cruciferous vegetables over \$35 million each year. One-acre test plots received 150, 300 or 600 pairs of each of the seven beneficial parasites. The plots with the two highest release rates had only 5 percent insect damage, compared to 25 percent in the unprotected control plot. The parasitic flies and wasps lay their eggs in the caterpillars, and the emerging larvae feed on the pests, eventually killing them.

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